# The Effect of Art and Science in Shaping Attitudes Towards Climate Change

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A report submitted as a partial requirement for the degree of Bachelor of Psychology with Honours at the University of Tasmania, 2019

**Statement of Sources**

I declare that this report is my own original work and that contributions of others have been duly acknowledged.

Date: 17th October 2019

**Acknowledgements**

I would like to thank my supervisor Dr. Kimberley Norris for encouraging a study of this kind and for her guidance, reassurance and enthusiasm throughout the year.

I would also like to thank the following:

- All of those who participated in this study
- Raku and Tilly for their unconditional love
- My parents Colin and Marianne and my friends and family for their support
- Dr. Matt Palmer, Dr. Don Hine and Dr. James Neill for their feedback
- Dr. Jim Sauer for coordinating the UTAS Honours program
- Dr. Gretta Pecl for her inspiration to consider a multidisciplinary project
- Dr. Carolyn Philpott for her assistance with music selection
- Johanna Van Der Hek for her assistance
- David from Millisecond online for his help in launching the study
- Amalia Patourakis and Silas Horsley for their editing and encouragement
- Climate scientists, climate artists, researchers in the field and climate action campaigners for their inspiration and commitment to change

*'If one does not look into the abyss, one is being wishful by simply not confronting the truth about our time... On the other hand, it is imperative that one not get stuck in the abyss*' (Lifton, 2012, p. 64)

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Word Count: 9,905

## Abstract

Climate change is an exigent problem which requires a substantial increase in action to mitigate. It has been suggested that art may shape attitudes towards climate change through evoking emotions which influence system 1 judgements. The current study investigated whether science or art-based auditory stimuli influenced attitudes towards climate change. 134 online participants were exposed to one of four stimuli conditions: climate change music, climate change music and science, non-climate change music and science, or science only. Participant's completed pre- and post-stimuli exposure measures of implicit and explicit Biospheric attitudes, positive and negative affect and cultural cognition worldview. Between-group analyses indicated that post-stimuli Biospheric implicit and explicit attitudes were significantly higher, and positive affect lower, irrespective of stimuli exposure. Within-group analyses suggested exposure to science only shaped the highest increase in Biospheric attitudes, climate change music only the lowest, and music (climate change or neutral, with or without science) significantly decreased positive affect. The implications of the current study for climate change communicators are that selected combinations of climate change music and science information can shape Biospheric attitudes, and whilst positive affect can be decreased by exposure to these mediums it does not directly relate to attitude change levels.

## Climate Change

There is overwhelming scientific consensus that anthropogenic climate change is occurring, with increasing deleterious impacts predicted for human, agricultural and natural systems (Gilden & Peters, 2017; IPCC, 2018). The Intergovernmental Panel on Climate Change (IPCC) continue to issue urgent, specific and comprehensive warnings whilst criticising the lack of action by governments and policymakers (Kintisch, 2014). The Australian Medical Association (AMA) recognise that climate change is an emergency impacting on human health, including higher incidence of mental ill-health (AMA, 2019). According to the Australian Psychological Society (APS) and American Psychological Association (APA) climate change demands the attention of the Psychology field as it is highly relevant to human behaviour, experience and wellbeing (APS, 2013; Clayton et al., 2016). Despite widespread concern about the impacts of climate change, there remains a prevalence of public ignorance, apathy, opposition, and denial regarding the severity of the risks (Gilden & Peters, 2017; Leviston & Walker, 2013). Substantial attitudinal and behavioural management changes are required on all levels of society to mitigate this global issue (Härtel & Pearman, 2010).

## Communication Issue

It has been argued that the most pertinent issue of climate change is determining effective communication strategies that increase social engagement and support for climate change mitigation policies (Moser, 2010; Reser & Bradley, 2017). Psychological science can contribute to the improvement of climate change communication by examining techniques which encourage the required globally cognisant attitudes, behaviours, social norms and cultural values (Gifford, 2008;

Weber & Stern, 2011). Climate change scientists, risk communicators and decision makers have found that the aforementioned changes are not occurring by providing the public with more detailed scientific information, therefore there is impetus to consider alternative methods (Hart & Nisbet, 2012b; Leiserowitz, 2006).

### Multidisciplinary Approach

Due to the scale, magnitude and intangibility of climate change, it has been labelled the ultimate 'super wicked problem' (Lazarus, 2009) and as such, responses to the issue need to be pluralistic. Many theorists aver that multidisciplinary research combining the arts, social-sciences, humanities and physical sciences is necessary to successfully investigate how people respond to different representations of the climate change issue (Clayton et al., 2015; Honeybun-Arnolda & Obermeister, 2019; Stevens, Connor, & Robinson, 2019). This research must incorporate and link different disciplines in meaningful ways to build on their unique strengths, 'for true meaning-making to occur, the humanities and the sciences must unite' (Boulton, 2016, p. 781). The current study is the beginning of a multidisciplinary collaboration to investigate effective methods for transmitting messages regarding climate change.

### Climate Art

Climate change related arts and cultural expressions (climate art) have been described as any artform aimed at exploring the theme of climate change and encouraging discussion and action (Marks, Chandler, & Baldwin, 2016; Roosen, Klöckner, & Swim, 2018). Roosen et al. (2018) completed a review of studies about climate art, specifically from a psychological theory perspective. They concluded that climate art can: lead to the emotional components of the issue, encourage high levels of attention and reflection, help audiences visualise the issue and possible

solutions in unique ways, allow personal connection with the topic, target specific populations, reach individuals in various stages of change.

Further proponents of climate art contend that it contributes to successfully communicating about climate change and stimulating attitude and behaviour change in audiences (Duxbury, 2010; Hollo & Rimmer, 2014). This is said to occur though climate art's unique capacity to: convey cultural meaning though emotional and experiential engagement, intercept political and cultural worldviews and overcome motivated reasoning (the tendency individuals have to fit new information to their beliefs) by leveraging more emotion-based biases, connect audiences with the ethical dimensions of climate change, and allow audiences to reflect on the issue, the role of humans in it and possible solutions (Corbett & Clark, 2018; Galafassi et al., 2018; Nurmis, 2016; van der Linden, Maibach, & Leiserowitz, 2015). There is increasing interest in the potential of various forms of climate art (such as visual art, film, music, poetry, fiction, photography and performance) to influence individuals, however there is no unified statement regarding how this impact occurs (Curtis, Reeve, & Reid, 2014; Galafassi et al., 2018; Moser, 2016).

### Evaluating the Influence of Climate Art on Attitudes

There is growing research in the area of using art to enhance climate change communication. Researchers have focused on climate change documentaries more than abstract climate art forms as they involve explicit information communication (Manzo, 2010). Similar to creators of other climate art mediums, documentary makers claim that their impact is through evoking emotional reactions from audiences (Beattie, Sale, & McGuire, 2011). Despite the widely held tenet of the social impact of documentary films, reviewers assert that there is insufficient empirical justification and more theoretical rigor is required to justify such claims

(Cooper & Nisbet, 2017; Karlin & Johnson, 2011). A meta-analysis concluded that climate change documentaries may influence perceptions of climate change, however they do not create long-term changes to attitude and behavior (Sakellari, 2015).

Some pertinent examples of studies involving other forms of climate art are outlined below, however there are limited studies that systematically investigate shifts in climate change attitudes following exposure to climate art. The reoccurring themes of deficit in these studies are non-experimental designs without control groups, the use of self-report methods and small sample sizes in some cases. Notably, each of the studies attribute the ability to arouse emotions as the main method through which climate art can impact attitude change.

Marks, Chandler, and Baldwin (2016) explored audience responses to an environmental art festival. Their survey-based self-report study involved 246 participants and concluded that the festival could foster environmental attitudes and encourage pro-environmental behaviours. Conversely, Keller, Sommer, Klöckner, and Hanss (2019) conducted a study in which 123 participants were exposed to artwork about the environment with or without contextualizing information. Their study found that whilst the information increased the personal meaning of the artwork for participants, there was no significant difference in pro-environmental intentions and behaviours between those who were exposed to the art in isolation and those who also received the contextualising information. Sommer and Klöckner (2019) conducted a study focusing on how participants perceive climate change related art. They collected questionnaires from 874 participants at an art festival that was occurring to coincide with United Nations change negotiations and found that

the style of artworks that incited the greatest cognitive and emotional responses were focused on the solutions to climate change rather than the issues.

Curtis (2010) conducted a qualitative case study of a community musical theatre performance event that involved semi-structured interviews ($n$ = 35), three focus groups ($n$ = 24) and a pre-post self-report survey ($n$ = 170). The author concluded that the performance engendered environmental attitudes and awareness by evoking a positive emotional response, and connecting artists with practitioners, however these conclusions were based on inference alone. A further experiment integrated climate art into an Australian ecological conference (Curtis et al., 2012). Participants ($N$ = 239) were observed by the researchers whilst engaging with the artforms throughout the conference sessions and answered a post-event questionnaire. Based on the results, the researchers concluded that the visual and performing arts elicited emotions, created new ways of perceiving issues and assisted delegates to synthesize information, and thus could be harnessed to support scientists to communicate scientific information.

### Theories of Climate Change Communication

According to the scientific literacy theory, the divide between climate scientists and the public results from the lack of scientific literacy in non-scientists, whose limited ability to engage in technical reasoning creates a reliance on fallible heuristics (Hart & Nisbet, 2012; Kahan et al., 2012). According to this theory, when science literacy increases public division regarding climate change should decrease. This theory was supported in a U.S study where those who were the most concerned about climate change had the most knowledge (Leiserowitz, 2010). However, Kahan et al. (2012) pose the cultural cognition theory as an alternative explanation of the relationship between public apathy over climate change and levels of science

comprehension since ‘public understanding of climate change needs improvement, but the problem is not one of “illiteracy”’ (Weber & Stern, 2011, p. 323)**.**

The cultural cognition theory suggests that people form beliefs about risks through mental processes influenced by their social and political positions (Kahan, 2015). Contrary to predictions posed by the science literacy theory, researchers have provided evidence that attitudes towards climate change become more polarised by socio-political values among members of the public with greater levels of scientific literacy (Drummond & Fischhoff, 2017; Kahan et al., 2012). Researchers have found a negative association between belief in climate change and level of scientific literacy specifically among people who hold more Hierarchical-Individualist views– who believe in authority based on social rankings and disregard the need for collective interference in decision making or individual wellbeing (Kahan, Jenkins-Smith, Tarantola, Silva, & Braman, 2015; Kahan et al., 2012). Scientific facts are ‘searched, remembered and assimilated’ to unite with pre-existing worldviews and political allegiances (Hornsey, Harris, Bain, & Fielding, 2016). As such, Kahan et al. (2012) argue that to be effective science communicators must provide information that doesn’t threaten group values, and people can believe it without becoming isolated from their communities.

### Environmental Values, Attitudes and Behaviours

The influence of environmental attitudes on pro-environmental behaviours is frequently explained using the Theory of Planned Behaviour (TPB) or the Value-Belief-Norm Theory (VBN). The TPB sees intention to act as the vital influence on behaviour, induced by attitudes, subjective norms and perceived behavioural control (Ajzen, 1991); the more these factors align the more likely a pro-environmental behaviour will occur (Gifford, Kormos, & McIntyre, 2011). A significant limitation

of this model is its incapacity to incorporate known barriers to acting on climate change (de Groot & Steg, 2008; Gifford, 2011). The VBN begins with an individual's environmental values, then emphases personal norms as the ultimate predictor of pro-environmental behaviour, influenced by beliefs towards responsibility and perceived consequences of the behaviour (Stern, 2000). It states that environmental values range from Biospheric to Egoistic, where individuals with Biospheric values promote concern for all living things and limited economic growth (Dunlap, Van Liere, Mertig, & Jones, 2000; Schultz & Zelezny, 1999). Conversely, an individual with Egoistic values prioritises self-enhancement, dominion over nature, and considers costs to themselves over benefits to others or the environment (de Groot & Steg, 2008; Stern, 2000). Researchers suggest environmental values are a theoretically reliable and valid influence on daily decision making and the predictability of environmentally sustainable behaviours (Schultz & Zelezny, 1999; Steg & Vlek, 2009; Thomas & Walker, 2014).

However, researchers have contended that an individual's environmental values, attitudes and behaviours are significantly more complicated than these models are able to predict. For example, one review listed seventeen categories of influences on environmental values, as diverse as childhood experience, personality and political worldview (Gifford & Nilsson, 2014). An alternative approach to predicting behaviours and changing attitudes stems from mounting evidence from behavioural economics, cognitive science and psychology regarding two distinct cognitive systems.

### System 1 and System 2 Thinking

Several theorists have posited two qualitatively different modes of information processing. This study will utilise the terminology which refers to

System 1 as affective, automatic and fast, and System 2 as conscious, abstract and deliberate (Kahneman, 2003; Stanovich & West, 2000). Despite these distinctions, the relationship between the two is complex and interconnected as both systems inform and influence each other (Kahneman, 2011). Similar to System 1 and System 2, the elaboration likelihood model of persuasion depicts 'central' and 'peripheral' as two decision making and persuasion routes (Petty & Cacioppo, 1986). The central route occurs via conscious, logical thinking when people are paying attention, whereas the peripheral route is taken when audiences are swayed by the superficialities of the situation (Petty & Cacioppo, 1986).

In regard to climate change communication, Zaval and Cornwell (2016) assert that rational deliberation about climate change is frequently overridden by common biases and judgements based on emotions and associations. A cogent example of the potential for system 1 decision making to influence climate change attitudes is the finding that audience levels of endorsement of the scientific inquiry is a better predictor of support for pro-environmental policies than levels of scientific literacy (Drummond, Palmer, & Sauer, 2016), as endorsement of the scientific inquiry links to system 1 judgements and the peripheral route through source credibility.

### Implicit and Explicit Attitudes

Researchers concerned with attitudes toward the environment and climate change often utilise explicit self-report measures in which participants are asked to indicate the amount they agree with descriptions of the relationship between humans and the environment (Dunlap, Van Liere, Mertig, & Jones, 2000). There are criticisms of the use of these measures due to the potential impact of social-desirability and demand characteristics. For example, respondents may promote

untrue beliefs (i.e. appear more supportive of the environment than they really are) to give a better impression (Beattie & McGuire, 2018; Thomas & Walker, 2014). These responses are said to cause discrepancies between implicit measures of attitude (scores on an Implicit Association Test) explicit measures of attitude (scores on a self-report test) and actual behavior, and are more likely to occur when measuring responses to socially sensitive topics (Greenwald, Poehlman, Uhlmann, & Banaji, 2009; McGuire & Beattie, 2018). A study investigating the relationship between implicit and explicit attitudes to carbon footprint found that self-report attitudes were not significantly associated with low carbon choices in a simulated shopping task (McGuire & Beattie, 2018). Furthermore, A meta-analysis concluded that pro-environmental behaviour self-report measures are prone to exaggeration and are 'only weakly associated with actual behaviour' (Kormos & Gifford, 2014, p.360).

An approach to addressing the reporting bias between self-report measures and behaviour is to gauge implicit attitudes, which are said to occur more in System 1 (Greenwald & Banaji, 2017; Kahneman, 2011). The Implicit Association Test (IAT) measures the strength of implicit associations by timing evaluations of word categories (Greenwald, McGhee, & Schwartz, 1998). The present study utilised a Biospheric IAT to gather a more accurate indication of automatic and underlying aspects of behaviour, given that climate change is a socially sensitive topic (Thomas & Walker, 2014).

### Attitudes and Affect

Attitudes are psychological constructs that underpin thoughts, emotions and behaviours (Kassin, Fein, Markus, McBain, & Williams, 2015). Attitudes have been theorised to consist of an affective and cognitive component (Breckler, 1985), with emotions and feelings comprising the former and beliefs and judgments the latter.

Researchers suggest that affect influences attitudes directly and independently of the cognitive structure (Bodur, Brinberg, & Coupey, 2000). Evidence gathered across psychological disciplines implies that decisions are impacted by affective routes equal to or more than by more analytic processes, and this applies to judgments about climate change (Weber & Stern, 2011). This aligns with research from dual processing system 1 and system 2 models (Kahneman, 2011).

Affect refers to the positive or negative feelings we experience at a given time (Barlow & Durand, 2015). Previous researchers suggest that an individual's affect is an important component in their risk evaluation, ethical and moral decision making, attitude formation and judgment, and can interact with their reason to directly influence how they respond to and process information (Bodur et al., 2000; Slovic, Finucane, Peters, & MacGregor, 2007).

**Music**

Researchers have proposed that listening to music can enhance positive affect, impact arousal levels, increase oxytocin and decrease cortisol levels (Campion & Levita, 2014; Ooishi, Mukai, Watanabe, Kawato, & Kashino, 2017; Thompson, Schellenberg, & Husain, 2001). Studies have indicated that music can been used for mood regulation and can intensify emotional experiences (Garrido, Schubert, & Bangert, 2016; Karreman, Laceulle, Hanser, & Vingerhoets, 2017). Furthermore, in a series of studies investigating the impact of advertising that incorporated 'moving' music (through which intense emotions were induced) researchers found that music increased behavioural intentions by increasing emotional engagement and transporting viewers into the story (Strick, de Bruin, de Ruiter, & Jonkers, 2015). Their results also imply that explicit attitudes were not

increased by the moving music, thus the change was affective (system 1) rather than cognitively based (system 2) (Strick et al., 2015).

### Affect and Climate Change Attitudes

According to Roeser (2012), affective responses may be the 'missing link' in communicating effectively about climate change, as they can create understandings about the moral implications of climate change. Similarly, researchers also suggest that reducing the emotional distance between an individual and the issue may motivate appropriate adaptive responses (Leviston, Price, & Bishop, 2014). Also, affect, emotion and personal experience influence risk perceptions and support for policies related to climate change (Leiserowitz, 2006; Slovic et al., 2007).

The main theory as to the effectiveness of climate art in changing attitudes to climate change is through influencing audience affect (Curtis et al., 2014; Marks et al., 2016; Sommer & Klöckner, 2019). However, there is mixed evidence in the literature regarding which specific affects are most effective at increasing attitudes to support climate change mitigation. Some findings suggest that a person's level of negative affect is positively related to their support of climate change policies and self-reported pro-environmental behaviours (Leviston & Walker, 2013; Wang, Leviston, Hurlstone, Lawrence, & Walker, 2018). For example, a study that investigated if viewing a climate change documentary changed participants subsequent mood and motivation to act on climate change found that happiness and calmness levels decreased following the footage, whilst motivations to act increased (Beattie et al., 2011).

The specific negative affect states of guilt and fear have been investigated, with mixed results. Researchers suggest that guilt can contribute to pro-environmental behaviours and the intentions behind them (Harth, Leach, & Kessler,

2013; Rees, Klug, & Bamberg, 2015). Whilst fear has the capacity to capture audience's attention to the importance of the issue, it can result in feelings of being overwhelmed, disengaged or powerless, and thus was claimed to be an 'ineffective tool for motivating genuine personal engagement' (O'Neill & Nicholson-Cole, 2009, p. 355). Additionally, it has been argued that strong emotional responses can terminate further thoughts on the topic due to a desire to avoid the associated distress (Slovic et al., 2007). Accordingly, climate change communication researchers suggest that fear-based arguments have run their course as effective tools for inspiring action (Reser & Bradley, 2017).

The use of positive emotions has also had mixed responses. The use of hope messages have increased participant action in some of the literature (Moser, 2015; Moser, 2016), whilst lowering the risk perception and decreasing action in other findings (Hornsey, Fielding, McStay, Reser, & Bradley, 2016). The influence of positive effect on self-report pro-environmental behaviour was suggested to be partially mediated by environmental concern and perceived consumer effectiveness (Coelho, Pereira, Cruz, Simões, & Barata, 2017). Consequently, an individual's emotional reaction to climate change information may be difficult to predict with certainty, however, must be considered when developing an effective communication strategy (Moser & Dilling, 2007; Roeser, 2012).

**The Present Study**

There is currently incommensurate public and support for the required climate change mitigation action (Gilden & Peters, 2017; Weber & Stern, 2011). Despite theorists as early as Plato and Aristotle contending that art can influence societal beliefs, attitudes and values, there have been insufficient investigations into the effectiveness of climate art in changing attitudes towards the issue (Belfiore &

Bennett, 2007), both alone and when combined with science information. Furthermore, affect has been highlighted as an important component of climate art's ability to facilitate attitude change. The current study sought to contribute to the deficits in these areas of research literature.

**Aims and Hypotheses**

The first aim was to systematically examine Biospheric attitude change outcomes following exposure to different combinations of climate art and science information (i.e. climate change music, climate change music + science information, non-climate change music + science information, or science information). A significant increase in implicit (measured by the Implicit Attitude Test) and explicit Biospheric attitudes (measured by the New Ecological Paradigm) from pre-stimuli baseline to post-stimuli exposure was hypothesised. A significant difference between different mediums was also hypothesised, with climate change music combined with science information expected to encourage the largest increase in Biospheric attitudes.

The second aim was to explore if these different combinations of climate art and science would influence post-stimuli exposure affect, as measured by the Positive and Negative Affect Schedule. It was hypothesised that those exposed to mediums with music (i.e. climate change music, climate change music + science information, non-climate change music + science information) would incur higher levels of affect change than the science information only medium. No directional hypothesis was formulated as previous literature does not conclude which affects would be influenced.

The third aim was to investigate the impact of cultural cognition worldviews (measured by cultural cognition worldview Hierarchical and Individualistic short-

form subscales) on implicit and explicit Biospheric attitudes. It was hypothesised that individuals with higher explicit Biospheric scores would have lower Hierarchical and Individualistic worldviews, as previous research had found (Kahan et al., 2012). Furthermore, it was hypothesised that Hierarchical and Individualistic worldviews and medium would account for significant proportions of the variance in predicting explicit attitude scores. It was also hypothesised that these patterns of results would not occur for Implicit attitude measures.

## Method

### Design

The current study employed a 2 [time: pre-stimuli exposure, post-stimuli exposure] x 4 [medium: climate change music, climate change music + science information, non-climate change music + science information, science information] repeated-measures design. The between-groups independent variable was medium (Table 1) and the within-groups dependent variables were pre- and post-stimuli exposure measures of implicit environmental attitudes, explicit environmental attitudes and affect, as well as cultural worldview. The inclusion of different combinations of stimuli embedded a manipulation check in the design

Table 1

*Medium and Participant Numbers*

| Medium | Number of participants |
|---|---|
| Climate change music (only) | 31 |
| Climate change music + science information (simultaneously) | 41 |
| Non-climate change music + science information (simultaneously) | 33 |
| Science information (only) | 29 |

## Participants

An a-priori sample size estimation performed using G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007) projected a sample size of 102 participants for a power of .80 and a moderate effect size ($d$ = .50). People under 18 years were precluded from this study with no further exclusionary criteria. 134 participants completed the online experiment (Table 1), 54 were first year University of Tasmania Psychology students, 41 were from online rapid recruitment platform Prolific and 39 via researcher networks. The study advertisement can be found in Appendix E.

## Materials

*Implicit Association Test* (IAT): An IAT was utilised to measure implicit Biospheric attitudes. The present study replicated the IAT developed by Thomas and Walker (2014). According to its developers, it is theoretically sound with substantiated criterion validity (Thomas & Walker, 2014). Online IATs have been proposed as a valid and reliable approach (Carpenter et al., 2018), therefore this study was conducted online to maximise the number of participants. The target categories were labelled ‘People focused’ (Egoistic) and ‘Non-People focused’ (Biospheric) to minimise disclosure of the study aim. The IAT utilised in this study involved a sequence of seven blocks (Table 2) in which participants were instructed to press keys to pair target category words (Biospheric or Egoistic) with attribute words (positive or negative).

Table 2

*Implicit Association Test Blocks*

| Block | Descriptor | Trials | Left key response category | Right key response category |
|---|---|---|---|---|
| 1 | Target Category sorting (practice trial) | 20 | Biospheric (E.g. Natural) | Egoistic (E.g. Prestige) |
| 2 | Attribute sorting (practice trial) | 20 | Good (E.g. Superb) | Bad (E.g. Terrible) |
| 3 & 4 | Hypothesis-consistent (first scored blocks)* | 20 + 40 | Biospheric + Good | Egoistic + Bad |
| 5 | Target Category sorting, reversed (practice trial) | 40 | Egoistic | Biospheric |
| 6 & 7 | Hypothesis-inconsistent (reversed scored blocks)* | 20 + 40 | Egoistic + Good | Biospheric + Bad |

*Note.* * Blocks were counterbalanced between subjects based on numerical subject ID

IAT scores were calculated following the improved algorithm procedure and were expressed in standard deviations ranging from -2 and 2 (Blanton, Jaccard, & Burrows, 2015; Greenwald, Nosek, & Banaji, 2003). A positive score showed support for an implicit association between ‘Biospheric-Good' and ‘Egoistic-Bad', whereas a negative score showed a stronger implicit inclination for ‘Egoistic-Good' and ‘Biospheric-Bad'.

*New Ecological Paradigm (NEP; Dunlap et al., 2000)*: The NEP was used to measure participants’ explicit Biospheric attitudes. Higher scores represented a preference for Biospheric values; lower scores a more Egoistic orientation.

*Cultural Cognition Worldview Scale (CCWS;* Kahan, Jenkins-Smith, & Braman, 2011): The short form Hierarchical and Individualistic subscales were utilised to measure participants cultural cognition. Higher scores indicate a preference for a hierarchical society oriented towards individualistic organization, respectively.

*Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegan, 1988)*: The PANAS was used to measure affect. Participants were asked to rate the extent they were experiencing specific emotions ‘at the present moment’. Higher scores on the positive affect (PA) scale represent higher levels of positive affect, lower scores on the negative affect (NA) scale representing lower levels of negative affect. High positive affect refers to the level an individual feels alert, active and enthusiastic, whereas low positive affect is depicted by lethargy and sadness. Conversely, high negative affect can include a range of distressing or unpleasant moods including anger, disgust, guilt, fear, and low negative affect being a more calm and serene state. (Watson et al., 1988). Example items and Cronbach’s alpha values for all questionnaires are represented in Table 3.

Table 3.

*Questionnaires and Reliabilities for the Present Study*

| Questionnaire | Subscale | Scale | Sample Item | Items | Cronbach's α |
|---|---|---|---|---|---|
| *New Ecological Paradigm* | n/a | 5-point Likert, "Strongly disagree" to "Strongly agree" | *"Humans are severely abusing the environment."* | 15 | 0.83 |
| *Cultural Cognition Worldview Scale* | *Hierarchical* | 6-point Likert, "Strongly disagree" to "Strongly agree" | *"We have gone too far in pushing equal rights in this country."* | 6 | 0.87 |
| *Cultural Cognition Worldview Scale* | *Individualistic* | 6-point Likert, "Strongly disagree" to "Strongly agree" | *"The government interferes far too much in our everyday lives."* | 6 | 0.81 |
| *Positive and Negative Affect Scale – Moment version* | *Positive* | 5-point Likert, "Very slightly" to "Very much" | *"Enthusiastic"* | 10 | 0.89 |
| *Positive and Negative Affect Scale – Moment version* | *Negative* | 5-point Likert, "Very slightly" to "Very much" | *"Nervous"* | 10 | 0.85 |

**Mediums**

The mediums utilised for the independent variable manipulation were all five-minute-long auditory stimuli. The music was chosen in consultation with Carolyn Philpott from the University of Tasmania's Conservatorium of Music. The climate change related music was Cheryl Leonard's *Ablation Zone* from *Antarctica: Music from the Ice* (2014). The artist's aim for this piece was to connect listeners 'viscerally or emotionally' with the impact of climate change on the Antarctic peninsula (Philpott, 2018). It combines recordings of disintegrating edges of glaciers and instrumentalisation on penguin vertebrae and nesting stones (Leonard, 2017) and the title refers to the area of glaciers where ice mass is melting, evaporating or being scoured by the wind (Evans, Rea, & Benn, 1998). The non-climate change music was the second Andante movement from Mozart's Piano Sonata K.283 in G Major. The science information was the article "*How Antarctic ice melt can be a tipping point for the whole planet's climate*" (Turney, Palmer, Kershaw, Phipps, & Thomas, 2017) used with permission and mixed with the music pieces to create the different mediums (Table 1).

**Procedure**

Approval was sought from the Tasmanian Social Sciences Human Research Ethics Committee (HREC) prior to data collection (Appendix G). The study was conducted online and accessed by participants following a link to the Millisecond host site. Prior to commencement participants viewed information outlining the purpose, method, data procedures and risks/benefits of the present study (Appendix F). Participants were randomly allocated to one of four mediums and asked to complete the IAT, NEP and PANAS pre- and post-stimuli exposure, along with the

CCWS. The New Ecological Paradigm questions were mixed amongst other questionnaires to reduce their impact in influencing attitudes. The study took approximately one hour to complete.

At the conclusion of the study participants were informed of the full purpose, as prior awareness may have impacted the reliability of responses. Participants then viewed a debrief script and could chose to submit their responses, which implied consent. Participants were thanked and first year Psychology students were granted 1-hour course credit, Prolific participants were paid 5 pounds and others were given the opportunity to enter a draw to win one of four $25 Coles-Myer vouchers.

## Results

### Data Analysis

All assumptions were evaluated prior to conducting analyses using Jamovi Version 1.0.5.0. A review of boxplots revealed outliers for some variables. These scores were all retained as they were within the plausible range and did not improve the model if removed. The assumption of normality was supported after examination of Shapiro-Wilk statistics and histograms, unless otherwise stated. As group sizes ranged from 29 – 41 participants, some of the findings outlined below must be interpreted cautiously as this is around the minimum sample sizes in which it is appropriate to apply the central limit theorem (Field, 2018). The homoscedasticity assumption was held by non-significant Levene's tests and Q-Q plots of residuals that were sufficiently clustered around the diagonal. As there were only two repeated-measures levels the assumption of sphericity was met (Allen, Bennett, & Heritage, 2014). Participants were asked to express the aims of the study in their own words to assess if knowledge about the aims of the study impacted on

responses. No significant difference was found between those who stated awareness and those who did not, therefore all responses were maintained in further analyses. Appendix C outlines further information about this analysis.

**Descriptive Statistics**

Descriptive statistics for medium and total sample are presented in Table 4. All scales were identified as having acceptable or good internal consistency within the current study. Cronbach's alpha values are not available for IAT scores; therefore, a split-half reliability method was conducted to calculate a reliability correlation between the first and second reaction time combined blocks (Schnabel, Asendorpf, & Greenwald, 2008).

Table 4

*Descriptive Statistics for Medium and Total Sample and Reliability Values for Total Sample*

| *M(SD)* | CCmusic | CCmusic+Science | NonCCmusic+Science | Science | *Total* | *Cronbach's* $\alpha$ |
|---|---|---|---|---|---|---|
| IAT 1 | 0.11 (0.64) | -0.35 (0.54) | 0.01 (0.61) | -0.50 (0.36) | -0.19 (0.60) | 0.725 [a] ($p$<.001) |
| IAT 2 | 0.19 (0.52) | -0.20 (0.49) | 0.16 (0.40) | -0.24 (0.45) | -0.03 (0.50) | 0.732 [a] ($p$<.001) |
| NEP 1 | 57.30 (7.83) | 58.50 (8.96) | 59.00 (7.24) | 58.40 (9.15) | 58.30 (8.28) | 0.812 |
| NEP 2 | 57.70 (8.12) | 60.40 (9.22) | 60.40 (9.29) | 60.10 (10.10) | 59.70 (9.16) | 0.863 |
| PA 1 | 24.80 (6.70) | 25.10 (9.00) | 27.40 (7.93) | 23.70 (7.59) | 25.30 (7.97) | 0.901 |
| PA 2 | 21.70 (7.46) | 23.20 (9.78) | 24.10 (8.74) | 22.70 (7.70) | 23.00 (8.54) | 0.928 |
| NA 1 | 12.60 (5.15) | 13.50 (4.47) | 14.70 (6.79) | 13.30 (4.12) | 13.60 (5.22) | 0.892 |
| NA 2 | 12.70 (3.71) | 12.90 (3.67) | 16.80 (8.26) | 14.10 (5.26) | 14.10 (5.66) | 0.900 |
| HIER | 14.30 (5.80) | 13.00 (6.02) | 12.40 (5.77) | 13.30 (6.28) | 13.20 (5.94) | 0.839 |
| IND | 21.20 (3.55) | 20.80 (5.51) | 22.30 (4.83) | 21.70 (4.29) | 21.40 (4.67) | 0.722 |

*Note. M* = Mean; *SD* = Standard Deviation; IAT 1 = Implicit Association Test, pre-stimuli exposure; NEP 2= New Ecological Paradigm, post-stimuli exposure; HIER = Hierarchical Scores; IND = Individualistic Scores; PA 1 = Positive Affect, pre-stimuli exposure; NA 2= Negative Affect, post-stimuli exposure; [a] = Reliability correlation.

A negative score on the IAT denoted an Egoistic-item preference over a Biospheric item-preference, a positive score showed the opposite pattern, with scores between 0 - 0.15 indicate no preference, 0.15 – 0.35 small, 0.35 – 0.60 medium and > 0.60 large preference (Greenwald et al., 2003). Results of the present study revealed two groups showed a mean medium sized preference for Egoistic items pre-stimuli exposure. Post-stimuli exposure the total mean score was near neutral between Egoistic and Biospheric preference. Compared to implicit attitudes, explicit attitudes were notably more Biospheric in this sample, as scores ranged from 15 – 75, this sample tended towards more Biospheric than Egoistic.

According to single sample t-test results, both positive and negative pre-stimuli exposure affect measures of the Positive and Negative Affect Scale (PANAS) for the current study sample were significantly below normative data levels (Appendix C). The HIER and IND scales range from 6 – 36, therefore the total sample mean for HIER is closer to the Egalitarian end of that spectrum. However, the total mean for IND was close to midway between individualistic and communitarian values.

**Medium**

*Implicit Attitudes*

A series of paired samples *t*-tests were used to compare mean within-group scores for implicit attitudes. Furthermore, a one-way analysis of covariance (ANCOVA) was used to examine whether exposure to the different mediums influenced levels of implicit attitude change between-groups. The dependent variable (DV) was post-exposure implicit attitude scores (IAT 2), the independent variable (IV) was the medium and the covariate was participants pre-stimuli exposure

implicit attitude scores (IAT 1). Despite an ANOVA revealing a significant difference between IAT 1 across mediums, the assumption of independence of covariate and the experimental effect of the IV was supported as random allocation was used therefore differences on the covariate arose by chance (Miller & Chapman, 2001). The assumption of homogeneity of regression slopes was supported by the absence of a significant IV-by-covariate interaction. A scatterplot indicated a linear relationship between the covariate and the dependent variable for all mediums. Table 5 outlines the results of the paired samples *t*-tests for within-group implicit attitude scores.

Table 5

*Paired Samples t-tests for Implicit Association Test Scores*

| Medium | *t* value | Degrees of freedom | *p* value [95% CI] | Cohen's *d* |
|---|---|---|---|---|
| Climate Change music only | -1.30 | 30 | .204 [-0.22, 0.05] | -0.23 |
| Climate Change music and Science information | -2.13 | 40 | .039* [-0.30, -0.01] | -0.33 |
| Non-Climate Change music and science information | -1.86 | 32 | .072 [-0.33, 0.01] | -0.32 |
| Science information only | -2.81 | 28 | .009** [-0.45, -0.07] | -0.52 |

*$p < .05$, **$p < .01$, ***$p < .001$

For within-subject analyses those in the climate change music and science information, and science information only mediums had on average significantly higher Biospheric IAT scores post-stimuli exposure. Results of the between-groups ANCOVA indicated that the covariate (IAT 1) was significantly related to the DV (IAT 2), $F$ (1,126) = 51.16, p < .001, $\eta^2$ = 0.27. For the whole sample mean Biospheric implicit attitude scores were significantly higher post-stimuli exposure, with a small effect size. Furthermore, after accounting for the pre-stimuli exposure scores (IAT 1) there was no significantly impact of medium on post-stimuli exposure (IAT 2) scores, $F$ (3,126) = 1.80, $p$ =.151, $\eta^2$ = .03. These results imply that there was a significant increase in implicit Biospheric attitudes between pre- and post-stimuli exposure.

*Explicit Attitudes*

To examine if exposure to different mediums influenced level of explicit attitude change a series of paired samples *t*-tests were used to compare mean within-group scores. Furthermore, for between-groups analysis an ANCOVA was deemed unsuitable for comparing explicit attitude measures for two reasons; firstly, there was no significant difference in pre-stimuli exposure NEP scores across mediums for, and secondly a significant interaction was found between the IV and covariate thus violating the assumption of homogeneity of regression slopes. Therefore, a 2 [time: pre-stimuli exposure, post-stimuli exposure] x 4 [medium: climate change music, climate change music + science information, non-climate change music + science information, science information] repeated-measures ANOVA was used. The DV was pre- and post-stimuli exposure NEP scores and the IV was medium. Table 6 outlines the results of the paired samples *t*-tests for within-group explicit attitudes.

Table 6

*Paired Samples t-tests for New Ecological Paradigm Scores*

| Medium | *t* value | Degrees of freedom | *p* value [95% CI] | Cohen's *d* |
|---|---|---|---|---|
| Climate Change music only | -0.81 | 30 | .425 [-1.59, 0.69] | -0.15 |
| Climate Change music and Science information | -3.03 | 40 | .004** [-3.25, -0.65] | -0.47 |
| Non-Climate Change music and science information | -2.36 | 32 | .024* [-2.54, -0.19] | -0.41 |
| Science information only | -2.87 | 28 | .008** [-2.78, -0.46] | -0.53 |

*$p < .05$, **$p < .01$, ***$p < .001$

The within-group analyses indicate the only medium to not have significantly higher Biospheric NEP scores post-stimuli exposure was climate change music only. The ANOVA results were significant indicating that NEP scores were influenced by time, $F$ (1, 130) = 19.66, $p < .001$, $\eta^2 = .01$, with a very small effect size. Therefore, mean Biospheric NEP scores were significantly higher post-stimuli exposure. However, there was no significant NEP by medium interaction, $F$ (3, 130) = 6.96, $p = .333$, $\eta^2 = .001$, nor was there a significant between-subject main effect of medium $F$ (3, 130) = 0.43, $p = .732$, $\eta^2 = .01$. These results indicate there was a significant increase in explicit Biospheric attitudes between pre- and post-stimuli exposure.

**Affect**

A series of paired samples *t*-tests were used to compare mean within-group scores for each medium for positive and negative affect. Table 7 outlines the results for positive affect.

Table 7

*Paired Samples t-tests for Positive Affect*

| Group | *t* value | Degrees of freedom | *p* value [95% CI] | Cohen's *d* |
|---|---|---|---|---|
| Climate Change music only | 2.96 | 30 | .006** [0.96, 5.23] | 0.53 |
| Climate Change music and Science information | 2.85 | 40 | .007** [0.54, 3.21] | 0.44 |
| Non-Climate Change music and science information | 3.45 | 32 | .002** [1.37, 5.30] | 0.60 |
| Science information only | 1.26 | 28 | .217 [-0.67, 2.80] | 0.23 |

*$p < .05$, **$p < .01$, ***$p < .001$

The within-subjects affect results indicate the only medium to not have significantly lower positive affect post-stimuli exposure was science only. For negative affect, only those in the non-climate change music and science information medium had a significant increase in negative affect post-stimuli exposure, $t$ (32) = -3.22, $p$ =.003, 95%CI [-3.31, -0.75], $d$ = -0.56, with a medium effect size.

Furthermore, two 2 [time: pre-stimuli exposure, post-stimuli exposure] x 4 [medium: climate change music, climate change music + science information, non-climate change music + science information, science information] repeated-measures ANOVAs were utilized to investigate the impact of the different mediums on the level of affect change in participants. The independent variable was the medium and the dependent variable was level of positive and negative affect pre- and post-stimuli exposure. Examination of Shapiro-Wilk $p$ values, boxplots and histograms suggested that the normality assumption was not met for any affect variable across all experimental groups, however the original data was retained in analysis due to sample size and transforming variables did not improve model output.

The ANOVA results suggest a significant main effect of time was found for positive affect, $F$ (1,130) = 28.57, $p$ < .001, $\eta^2$ = .02, with a very small effect size. Across the whole sample positive affect levels post-stimuli exposure were significantly lower than at the beginning of the experiment, however a significant main effect for medium was not found, $F$ (3, 130) = .72, $p$ = .545, $\eta^2$ = .01. A significant main effect was not found for negative affect between pre- and post-stimuli exposure, $F$ (1,130) = 2.92, $p$=.090, $\eta^2$= .00. Similarly, a significant main effect for medium was not found for negative affect , $F$ (3, 130) = 2.39, $p$=.072, $\eta^2$=.04.

**Cultural Cognition Worldview**

To estimate the proportion of variance in explicit attitude scores (NEP) and implicit attitude scores (IAT) that could be accounted for by a participant's cultural cognition worldview scores (Hierarchical – HIER; Individualistic – IND) standard multiple regression analyses were performed. Further assumptions were tested before interpreting the results. The Cook's Distance maximum for this regression analyses was 0.05, indicating no influential cases. Despite significant Shapiro-Wilk values for some variables in this analysis, given the sample size (*N*= 134) the central limit theorem was used to justify sufficient normality. Linearity, homoscedasticity and normality of residuals were confirmed by inspection of Q-Q and scatter plots. Multicollinearity was not evident in the variables and the ratio of cases to predictors was reasonable to assume medium-sized effects (Tabachnick & Fidell, 2013). Table 8 outlines the correlations between cultural cognition worldview measures and Biospheric attitudes.

Table 8.

*Pearson Correlation Statistics for Variables*

| Variable | NEP 1 | NEP 2 | IAT 1 | IAT 2 |
|---|---|---|---|---|
| IND | -0.08 | -0.10 | -0.01 | 0.03 |
| | [-0.25, 0.09] | [-0.25, 0.09] | [-0.27, 0.07] | [-0.15, 0.19] |
| HIER | -0.58*** | -0.57*** | -0.13 | -0.09 |
| | [-0.68, -0.46] | [-0.68, -0.45] | [-0.29, 0.05] | [-0.25, 0.08] |

*Note.* 95% CI in brackets; NEP = New Ecological Paradigm; IAT = Implicit Association Task; IND = Individualistic; HIER = Hierarchical

*$p < .05$, **$p < .01$, ***$p < .001$

A significant medium-large (Field, 2018) negative correlation was found between HIER and both NEP scores. There were no significant correlations between IND scores and NEP and IAT scores, nor were there significant correlations found between HIER scores and IAT scores. Results from the regression analyses suggests that HIER accounts for significant variability in post-exposure NEP scores, adjusted $R^2 = .32$, $F\ (1, 132) = 64.1$, $p < .001$. Adding IND to the model did not significantly increase the predictability of post-exposure NEP scores $F\ (1,131) = 0.69$, $p = .415$. HIER accounted for a similar amount of variability in pre-exposure NEP scores, adjusted $R^2 = .33$, $F\ (1, 132) = 67.0$, $p < .001$. Whilst HIER scores predicted a significant proportion of unique variance in NEP scores, neither HIER nor IND were a significant predictor for either IAT scores. The standard multiple regression results are outlined in Table 9 and Table 10.

Table 9

*Regression Model Predicting Post-Stimuli Exposure New Ecological Paradigm Scores*

| Variable | B [95% CI] | SE B | β [95% CI] |
|---|---|---|---|
| HIER | -0.91 [-1.14, -0.68]*** | 0.12 | -0.59 [-0.74, -0.44] |
| IND | -0.12 [-0.17, 0.41] | 0.15 | 0.06 [-0.09, 0.21] |

*Note. N*=134; CI = confidence interval; HIER = Hierarchical; IND = Individualistic;

B = Unstandardised Regression Coefficients; SE = Standard Error;

β = Standardised Regression Coefficients

****p* < .001

Table 10

*Regression Model Predicting Pre-Stimuli Exposure New Ecological Paradigm Scores*

| Variable | B [95% CI] | SE B | β [95% CI] |
|---|---|---|---|
| HIER | -0.84 [-1.05, -0.64]*** | 0.10 | -0.60 [-0.75, -0.46] |
| IND | 0.15 [-0.11, 0.41] | 0.13 | 0.08 [-0.06, 0.23] |

*Note.* $N = 134$; CI = confidence interval; HIER = Hierarchical; IND = Individualistic;

B = Unstandardised Regression Coefficients; SE = Standard Error;

β = Standardised Regression Coefficients

***$p < .001$

Furthermore, hierarchical linear regression was conducted to investigate the predictive power of HIER, IND and medium interactions on NEP and IAT scores with the change in adjusted *R*-square across each step in the regression analysis used as an indication of the influence of variables when previous variables were taken into account. Medium was not found to account for a significant amount of variance in NEP scores, $\Delta R^2 = .00$, $\Delta F\ (3,129) = 0.30$, $p = .827$. Furthermore, when the HIER times medium interaction was added it did not account for a significant amount of variance in NEP scores $R^2 = .02$, $\Delta F\ (3,126) = 1.34$, $p = .266$. As Table 11 outlines, HIER scores was the only significant predictor of NEP scores in this regression model.

Table 11

*Hierarchical Regression Analysis Predicting New Ecological Paradigm Scores*

| Variable | B [95% CI] | SE B | β [95% CI] |
|---|---|---|---|
| HIER | -0.89 [-1.11, -0.67]*** | 0.11 | -0.58 [-0.72, -0.08] |
| MEDIUM | | | |
| 1-2 | -1.54 [-10.74, 7.65] | 4.65 | -0.19 [-1.33, 4.96] |
| 3-2 | 5.05 [-3.39, 13.48] | 4.26 | 3.27 [-2.19, 1.67] |
| 4-2 | 6.10 [-2.61, 14.81] | 4.40 | 0.76 [-0.32, 9.60] |
| HIER*MEDIUM | | | |
| 1-2*HIER | -0.02 [-0.64, 0.59] | 0.31 | - |
| 3-2*HIER | -0.44 [-1.05, 0.16] | 0.31 | - |
| 4-2*HIER | -0.47 [-1.07, 0.13] | 0.30 | - |

*Note.* CI = Confidence Intervals; HIER = Hierarchical; B = Unstandardised Regression Coefficients; SE = Standard Error; β = Standardised Regression Coefficients

***p<.001

# Discussion

This main aim of the current study was to systematically assess the degree of change in explicit and implicit Biospheric attitudes between pre- and post-stimuli exposure to auditory climate art and science information mediums. A further aim was to investigate the level of change in positive and negative affect pre- and post-stimuli exposure. The final aim was to explore the relationship of cultural cognition worldview with Biospheric attitudes and medium. It is important to recognise here that there are many different forms of climate art and types of science information and this study measured one of each, in different combinations. Therefore, whilst these findings are not generalizable to the broad realms of 'art' or 'science', this study has contributed to the literature in the field nonetheless by finding that selected combinations of climate change communication significantly increasing implicit and explicit Biospheric attitudes as well as decreasing the positive affective of participants who listened to them. This study also specifies findings that align with past research regarding the cultural cognition thesis, whilst contributing a unique finding to the literature that implicit Biospheric attitudes were not related to Hierarchical or Individualistic worldviews.

## The Effect of Art and Science on Climate Change Attitudes

It was hypothesised there would be a significant increase in both implicit and explicit Biospheric attitudes from pre-stimuli baseline to post-stimuli exposure. This hypothesis was supported by the between-group analyses, as mean implicit and explicit scores became significantly more Biospheric post-stimuli exposure for the entire sample. The prediction there would be a significant difference between different mediums was not supported by the between-groups analyses as no

significant impact of medium was found on these outcomes. However, there were three patterns of data from within-group analyses that are of interest; these must be interpreted cautiously as whilst three mediums had moderate within-group effect sizes, they were not different enough to be significant between-groups.

Firstly, participants who were only exposed to the climate change music did not have a significant increase from baseline levels to post-exposure for either implicit or explicit attitudes. This finding implies that this specific climate art example may be ineffective in changing attitudes by itself. This finding is contrary to the previous studies in the literature that aver the potential for climate art to change attitudes towards the issue of climate change (Curtis et al., 2012; Marks et al., 2016). In this scenario it is worth considering the role that context can play in audience interpretation of art. For example, perhaps the power of the climate change inspired music piece to change attitudes would have increased if the audience had experienced a live performance in a concert hall or were exposed to additional contextualising information to support the composition and make it more personally meaningful (Keller et al., 2019).

Secondly, the climate change inspired music with science combination had a greater impact on listeners than the non-climate change inspired music and science combination for both explicit and implicit attitudes. This finding validates the intention of the climate artist in creating this piece, according to the artist ‘We already know we should be scared [about climate change] … but it’s not encouraging change…we need to go for the heart, and that’s where music and other art forms can be very effective’ (Leonard 2015, as cited in Philpott, 2018, p. 48). Furthermore, this finding is supported by literature that discusses the potential of context-based soundscape compositions that address environmental issues and are

created from real-world experiences (Philpott, 2018). Another reason that this medium may have experienced greater levels of attitude change was the congruence between the science information and climate change music, as both focused on ice melt in Antarctica. Conversely, when combined with the non-climate change inspired composition the science information may have created discord for participants, for example '…I felt I was on hold to Centrelink whilst simultaneously listening to science; they didn't really go together' (current study participant, personal communication 1st August 2019).

Thirdly, the science only medium had the highest level of effect size of attitude change for both implicit and explicit attitudes in this study. This finding is not supported by literature that suggests science information alone is insufficient in changing climate change attitudes, for example Kellstedt, Zahran and Vedlitz (2008) propose the more people know about climate change the less concerned they feel about it. Furthermore, this finding does not support the hypothesis that the climate change music combined with science information would create the highest change in attitude, despite significant increases between pre- and post-stimuli exposure levels of both implicit and explicit attitudes for this medium.

The finding that adding music to science did not augment attitude change was a surprising result theoretically, as climate art appeals to information processing system 1 and implicit attitude change, therefore when combined with science information (more targeted at system 2) it was anticipated to have the capacity to reduce the motivated processing of information and increase positive responses to climate change related messages. Furthermore, previous research has argued that art can enhance the effectiveness of science communication. Although there are a handful of studies in the literature that have found an effect of climate art and

science combinations on levels of attitudes (Arce-Nazario, 2016; Curtis et al., 2012) their circumstances were different to the present study in several ways. Specifically, they did not randomly allocate participants to different forms of communication (i.e. science) for manipulation and comparison tests and they utilised qualitative interviews or self-report questionnaires which have limitations when garnering the influence on attitudes.

**The Influence of Affect**

The second aim of the current study was to assess if the different medium combinations created different levels of affect change post-stimuli exposure. Between-group results suggest that for the entire sample participants were significantly less positive in affect than they were in the pre-stimuli exposure baseline, with no significance of medium.

However, the hypothesis that those who were exposed to music (either by itself or with science) would have greater levels of affect change was supported by within-group analyses as they suggest that science was the only medium that didn't have a significant decrease in positive affect, the music groups all had moderate effect sizes. This finding aligns with research from music literature that suggests music can evoke and intensify emotions and change affect (Husain, Thompson, & Schellenberg, 2002; Van Goethem & Sloboda, 2011), however the reduction of positive affect is contrary to literature that focuses on the ability of music to improve positive moods (Lynar, Cvejic, Schubert, & Vollmer-Conna, 2017; Oetken et al., 2017). The current study does not provide clear support of the argument that it is through evoking emotions or appealing to system 1 decision making processes that climate art has the potential to change attitudes, as there wasn't a clear link between

decreased affect and increased levels of attitude change between each of the mediums.

The finding that across the entire sample positive affect decreased and both implicit and explicit attitudes towards climate change increased corresponds to previous research in the field that negative affect is related to climate change policy support (Leviston, Greenhill, & Walker, 2015; Wang, Leviston, et al., 2018). It also aligns with arguments that climate change information can evoke strong emotional responses, including decrease in positive affect, and that it is a delicate task for climate change communicators to handle this ability sensitively (Boulton, 2016). These results also support findings from an experiment probing the influence of a climate change film (with a musical soundtrack) on participants subsequent mood in which researchers found happiness levels decreased post-exposure (Beattie et al., 2011).

When focusing more specifically at the affect changes that occurred, according to their self-reports participants in the current study decreased in feelings of being alert, excited, inspired, strong, determined, attentive, enthusiastic, active and proud. This corresponds to research that details apathy and avoidance as potential mental health strategies to deal with issues such as climate change (Markowitz, Hodge, & Harp, 2014; Moser & Dilling, 2007). Contrary to previous research that has linked feelings of guilt and fear to receiving climate change communication, these did not significantly increase during this study (O'Neill & Nicholson-Cole, 2009; Rees et al., 2015).

This study has contributed to the field by further indicating that emotional responses to climate change information may be related to potential changes in attitudes. However, it poses more questions about the complex relationship that

music and information have on affect, and whether affect is a key driver of broader decision-making processes, or attitude and behaviour change. It also raises questions about the theoretical implications of utilising communication targeted at system 1 information processing. More broadly it raises questions about the ethics of specifically trying to decrease people's affect to 'nudge' them towards more Biospheric attitudes and behaviours (Schubert, 2017).

**The Influence of Cultural Cognition Worldview**

The third aim of the current study was to investigate the relationship between cultural cognition worldview, implicit and explicit attitudes to climate change and responses to different mediums of climate change information. It was predicted that individuals with higher explicit Biospheric scores would have lower levels of Hierarchical and Individualistic worldviews. Furthermore, it was hypothesised that Hierarchical and Individualistic worldviews and medium would account for significant proportions of the variance in predicting explicit attitude scores. Additionally, it was hypothesised that these patterns of results would not occur for implicit attitude measures.

As predicted, participants with higher explicit Biospheric values had lower levels of Hierarchical worldview scores. This aligns with previous research in the field (Kahan et al., 2015, 2012). The hypothesis that medium would account for a significant proportion of the variance in explicit attitudes beyond that predicted by cultural cognition worldview was not supported, as adding medium to the regression model did not have a significant effect.

The finding that across the sample cultural cognition worldview was not related to implicit attitude contributes to the field, as implicit attitudes have not been related to the cultural cognition worldview scale to date. This finding suggests that

whilst participant's explicit measures may be paired with their cultural cognition worldview, implicit attitudes may be less likely to be impacted on by socio-political forces such as social desirability. Alternatively, the system 1 processes may intercept the potential influence of cultural cognition on implicit judgement and decision making. As Kahan et al. (2012) argue, individuals form their risk perceptions (including climate change attitudes) in ways that reinforce identity, which is closely related to preferences for societal organisation and our social groups. This finding requires more investigating as to whether implicit attitudes are able to bypass an individual's motivations to protect their identity.

**Limitations**

The present study has several limitations that need to be taken into account when generalising or drawing conclusions from the results.

The first two limitations are regarding participants. Firstly, there are potential confounds regarding the affect change in participants. It is possible that given the length of the experiment participant fatigue and loss of attention may have contributed to the change in affect, rather than the exposure to climate change related information. Secondly, despite those who stated awareness of the study aim not having significant differences in responses to those who did not state awareness, it must be considered that the information may not have been received the same way due to this understanding.

The third limitation of the current study is that the implicit attitude test has its issues and criticisms. According to Blanton, Jaccard and Burrows (2015) the scoring method utilised by many IATs (including the current study) should not be used for assessment as they obtain levels of variability by requiring the presence of random noise. Furthermore, whilst the developers of IAT employed in the current study have

specified that it scores the relative level of implicit preference for either Biospheric or Egoistic, it cannot be confidently stated that these personal values are measured by this method. The current study also utilised explicit attitude measures and there were no significant differences between the two attitude measures. However, the limitations of the IAT must be considered in future studies in which other implicit attitude measures may be more suited, for example the decision response task.

Fourthly, the exposure to stimuli may not have been insufficient in length and too passive to create lasting change in attitudes. Also, the stimuli in this study was utilising only one sense (hearing) which may have reduced the ability to change attitudes and to maintain attentiveness, compared to other art forms (for example: visual art, theatre, or documentary film). Moreover, literature discusses that art that is interactive and participatory has the potential to be more effective in increasing sympathetic attitudes towards climate change (Lesen, Rogan, & Blum, 2016; Marks et al., 2016), as well as art that is place based and developed to convey the future climate impact relevant to the places where the artists live (Capstick, Hemstock, & Senikula, 2018). Future research may consider comparing shorter and longer exposures to climate change art, as well as interactive, participatory and place-based styles of climate art.

The fifth limitation of the current study is the possible impact of order of measurement on implicit and explicit Biospheric measures. Studies conducted by Nosek, Greenwald and Banaji (2005) found no reliable or consistent effects of measurement order on the outcomes of implicit tests and self-report measures, also the effect was more likely to occur for novel attitudes or when the self-report measure had 30 items or more. Due to the well publicised nature of climate change, and the 15 item New Ecological Paradigm as the explicit attitude measure, these do

not apply to the current study. Furthermore, in order to reduce the possibility of this effect, the New Ecological Paradigm questions and other non-related questionnaires were scattered, and the target categories were labelled ‘People focused’ (Egoistic) and ‘Non-People focused’ (Biospheric).

**Future Research**

The first suggestion for future research would be to conduct research that systematically investigates the impact of climate art focused on a specific component of the issue with science information that corresponds to that issue with measures that relate to that component. As climate change is a complex, multifaceted and super wicked problem, future studies may obtain higher effects in their findings from reducing the size of the scope of the question. For example, Paton et al. (2019) focused on the way that people relate to environmental hazards and the impact that song lyrics may have on these relationships to influence community-based disaster risk reduction.

The second suggestion would be to continue to investigate the impact of utilising messages that target both the central route and the peripheral route of persuasion, and system 1 and system 2, simultaneously. Theorists posit that messages transmitted via the central route can result in permanent change however attitudes influenced by the peripheral route are less permanent (Petty & Cacioppo, 1986). It is advised that future research utillise recommendations from the research such as: source credibility and narrative storytelling. Researchers illustrate that messages are more likely to be attended and responded to if they come from sources that are trusted and attractive (Clayton et al., 2015; Marks et al., 2016), so ensuring a level of trust in the messenger of information links to source credibility bias via the peripheral route. Furthermore, there is evidence that utilising narrative stimuli and

storytelling is as they increase motivation and mental processing (Cooper & Nisbet, 2017; Lewandowsky & Oberauer, 2016), and these forms link to the central route of persuasion.

Thirdly, it is suggested that future research incorporates longitudinal studies that can investigate how the impact of art and science in shaping attitudes towards climate change may translate over time. The present study measured and analysed changes in affect and attitude that were momentary after listening to particular climate change art and science information, however, did not measure if these decreases in positive affect or changes in implicit and explicit attitudes were long lasting, or would revert in time. An important follow up study would be to assess the potential for different stimuli to impact on longer term changes in affect and attitudes towards about climate change. Furthermore, the current study did not analyse the impact on behavior change in the short term or long term, whereas previous research has tested the motivation level of participants to act on climate change (Beattie et al., 2011) which is an important component to consider in future studies. Given the paradoxical nature of climate change being both urgent as well as slow to occur and long term, ongoing disruption of everyday routines are required to reflect and consider behaviour change (Roosen et al., 2018).

Future research questions in the realm of affect and climate change information can benefit from investigating which particular affects are more susceptible to being evoked by climate change art. For example, Sommer and Klöckner (2019) posit that for climate art to have optimal impact it should catch audience attention by depicting the gravity of the issues, then move on to emphasise the beauty of nature and focus on the solutions to the issue. They argue that the most effective form of climate art would not just evoke emotions by showing the issue

aesthetically it would create personal connections to the cause and consequences whilst offering solutions. There are also suggestions within the literature that combining climate change information with guidelines for pro-environmental behaviours (such as improving home energy efficiency, recycling or sustainable transport) by can reduce the negative impacts of emotional responses (Lowe et al., 2006; Wang, Corner, Chapman, & Markowitz, 2018). Additional suggestions for future studies are to investigate the ability of climate art to transport the listener into the story of the information (Strick et al., 2015) and reduce the emotional distance of the listener from the issue (Leviston et al., 2014) as this study was unable to determine whether the climate change inspired music intervention was successfully in either of these areas.

Furthermore, due to the cultural division on climate change, future research could better encompass the literature around audience segmentation (Hine et al., 2014). According to (Chapman, Lickel, & Markowitz, 2017) to develop successful climate change communication it is important to meet the emotional, informational and decision-making needs of the audience, which requires more nuanced approaches than a one-size-fits-all style of communication (Kahan, 2015). To successfully communicate and change behaviours, individual capabilities, biases, values, beliefs, norms, social relationships and cognitive processes need to be considered and integrated into how humans interact with a changing climate (Markowitz & Guckian, 2018). For example, one form of audience segmentation, further to political beliefs and climate change attitudes, is the psychological distance and personal experience that audiences have with climate change (Manning et al., 2018; McDonald, Chai, & Newell, 2015). A previous example from Sakellari (2015) found that responses to difference climate change films were different between those

already engaged with the issue, than for sceptics or those who were unengaged. Researchers in this field suggest that these forms of communication are more difficult to conduct, as it can be challenging to identify audiences and messages can become cross-contaminated, however they are likely to have better effect and more research is required. (Hine et al., 2017),

**Conclusion**

Climate change is the most extreme issue humanity has ever faced. Whilst science continues to inform us that it is happening and it is human activity that is driving it, the response of governments and the public remains inadequate. The present study represents a step towards understanding the effect of art and science in shaping attitudes towards the issue. There are many different types of climate art and forms of science information that can be measured, this study provides information on a soundscape inspired by melting icebergs in Antarctica.

The results from this study have implications for climate change communicators. The results imply that when combined with science information climate change inspired music may be more successful in shaping attitudes than when presented by itself or with non-climate change inspired music. Findings also suggest that the missing link to changing climate change attitudes may not be climate art, as in this study science information itself was the most effective in effectively changing attitudes. Results also indicate that if science communicators wish to emotionally engage audiences, the use of climate art may be valuable. The finding that changes in affect are not directly linked to increases in Biospheric attitudes implies that the mechanisms of change are not clear due to the complexity of interactions between these mediums and variables.

Whilst this study provides evidence that climate art and science can produce emotional responses that may change the way we think, feel and consequently may influence how we act about climate change, it raises more questions about how communicators in this area use the strengths of both the arts and science to increase their capacity to change people's attitudes. Future research is needed to support the results of the present study and to further evaluate the effectiveness of proposed interventions. The development of an evidence-based understanding of the impact of different forms of climate change information will help communicators to be more effective in transmitting their message. It is apparent that the climate crisis will not be solved through our rational minds alone (Weber, Bauman, & Eliasson, 2014) and climate artists may be able to provide inspiration and hope (Perovich, 2018), however, more evidence is required as to the potential for climate related art to adequately motivate change.

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**Appendix A**

**Participant Demographic Variables**

| | Count (%) |
|---|---|
| *N* | 134 |
| Sex | |
| Female | 81 (60.4) |
| Male | 50 (37.3) |
| Other | 2 (1.5) |
| Prefer not to answer | 1 (0.7) |
| Education | |
| Less than high school | 2 (1.5) |
| High school diploma or equivalent | 30 (22.4) |
| Some college no degree | 21 (15.7) |
| Postsecondary non-degree award | 13 (9.7) |
| Bachelor's degree | 43 (32.1) |
| Master's degree | 18 (13.4) |
| Doctoral or professional degree | 5 (3.7) |
| Prefer not to answer | 2 (1.5) |
| Age | |
| 18-24 | 49 (36.6) |
| 25-34 | 39 (29.1) |
| 35-44 | 30 (22.4) |
| 45-54 | 12 (9.0) |

| | |
|---|---|
| 55-64 | 4 (3.0) |
| 75 or older | 0 (0.0) |
| Prefer not to answer | 0 (0.0) |
| Political Orientation | |
| Very liberal | 25 (18.7) |
| Liberal | 45 (33.6) |
| Moderate | 32 (23.9) |
| Conservative | 6 (4.5) |
| Very conservative | 1 (0.7) |
| Prefer not to answer | 25 (18.7) |
| Annual household Income | |
| Less than $25,000 | 25 (18.7) |
| $25,000 - $34,999 | 22 (16.4) |
| $35,000 - $49,999 | 18 (13.4) |
| $50,000 - $74,999 | 12 (9.0) |
| $75,000 - $99,999 | 11 (13.4) |
| $100,000 - $149,999 | 11 (8.2) |
| $150,000 - $199,999 | 4 (3.0) |
| $200,000 or more | 4 (3.0) |
| Prefer not to answer | 20 (14.9) |
| Natural Disaster Experience (More than one is possible) | |
| Cyclone | 8 (6.0) |
| Bushfire | 42 (31.3) |

| | |
|---|---|
| Drought | 20 (14.9) |
| Flood | 43 (32.1) |
| Other natural disaster | 19 (14.2) |
| None of the above | 61 (45.5) |
| Season | |
| Winter | 79 (59.0) |
| Spring | 7 (5.2) |
| Summer | 36 (27.9) |
| Autumn/ Fall | 12 (9.0) |
| Country of Birth | |
| Australia | 74 (55.2) |
| United Kingdom | 12 (9.0) |
| Poland | 9 (6.7) |
| Italy | 5 (3.7) |
| New Zealand | 3 (2.2) |
| Portugal | 3 (2.2) |
| Other | 28 (21) |
| Climate change belief one item | |
| I do not have an opinion about climate change | 5 (3.7) |
| As far as I am concerned, climate change is not an issue | 6 (4.5) |
| Climate change is an issue, and I believe things should | 80 (59.7) |

| | |
|---|---|
| be done to address it | |
| I actively do things to address the issue of climate change | 43 (32.1) |
| Attention to the stimuli | |
| 5 or below | 34 (25.4) |
| 6 or above | 100 (74.6) |
| Have you attended a religious service in the last 7 days? | |
| Yes | 8 (6.0) |
| No | 126 (94.0) |

**Appendix B**

**Demographic Questions**

| Question | Response Options |
|---|---|
| Which season is it currently where you live? | Summer, Fall/ Autumn, Winter, Spring |
| Have you attended a religious service in the last 7 days? | Yes, No |
| What is your sex? | Female, Male, Other, I prefer not to answer this question |
| What is your age? | 18-24 years old, 25-34 years old, 35-44 years old, 45-54 years old, 55-64 years old, 65-74 years old, 75 years or older, I prefer not to answer this question |
| What is the highest degree or level of schooling you have completed? If currently enrolled, highest degree received so far. | Less than high school, High school diploma or equivalent, Some college no degree, Postsecondary non-degree award, Bachelor's degree, Master's degree, Doctoral or professional degree, I prefer not to answer this question |
| Have you ever experienced a natural disaster warning or natural disaster impact situation for the following? | Cyclone, Bushfire, Drought, Flood, Other natural disaster, none of the above, I prefer not to answer this question |
| What is your country of birth? | Participants were asked to select from a |

| | |
|---|---|
| | drop-down list. |
| Please select the statement that you most agree with | As far as I am concerned, climate change is not an issue, Climate change is an issue, and I believe things should be done to address it, I actively do things to address the issue of climate change, I do not have an opinion about climate change |
| How would you describe your political orientation? | Very liberal, liberal, moderate, conservative, very conservative, I prefer not to answer this question |
| What was your total household income before taxes during the past 12 months? | Less than $25,000, $25,000 to $34,999, $35,000 to $49,999, $50,000 to $74,999, $75,000 to $99,999, $100,000 to $149,999, $150,000 to $199,999, $200,000 or more, I prefer not to answer this question |
| Please write a few words about what this study is researching… | Open response |
| On a scale of 1 (not at all) and 10 (completely) how would you describe your level of attention to the auditory stimuli you were exposed to throughout this study? | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 |

## Appendix C

### Single sample *t*-tests for affect

A one sample *t*-test was used to compare the average pre-stimuli exposure positive affect score from this sample ($M$ = 25.30; $SD$ 7.97) with the normative data provided by Watson et al. (1988) ($M$ = 29.7; $SD$ = 7.9). The *t*-test was significant $t$ (133) = -6.40, $p$ <.001, $d$ = -.553, 95% CI of the difference [-5.76,-3.04].

A one sample *t*-test was used to compare the average pre-stimuli exposure negative affect score from this sample ($M$ = 13.60; $SD$ = 5.22) with the normative data provided by Watson et al. (1988) ($M$ = 14.8; $SD$ = 5.4). The *t*-test was significant $t$ (133) = -2.75, $p$ = .007, $d$ = -.238, 95% CI of the difference [-2.13, -0.35].

## Appendix D

### Awareness of Study Aims

Participants were asked to express their interpretation of the study aims after completing the study. This allowed an assessment of whether awareness of the study aims impacted results. Participants that mentioned climate change in their response were classified as 'aware' ($n$ = 44) and those that did not were classified 'unaware' ($n$ = 90). Student's independent samples $t$-tests compared IAT and NEP scores of 'aware' and 'unaware' participants. The homogeneity of variance assumption was met as Levene's scores were not significant and no outliers were evident. A violation of normality was suggested by inspection of Shapiro-Wilk scores and Q-Q plots. The skewness value was $z_s$ =2.06, indicating a significant skew at $p$<.05 level, but not $p$<.001 level (Allen et al., 2014). Given the size of the group ($n$=90) and that the purpose of the analysis was not to generalise to the broader population the analysis was conducted despite this violation.

The $t$-tests for implicit attitude (IAT pre-stimuli; IAT post-stimuli) were not significant between 'aware' ($M$ = -0.16, $SD$ = 0.52; $M$ = -0.02, $SD$ =0.44) and 'unaware' groups ($M$ = -0.21, $SD$ = 0.64; $M$ = -0.03, $SD$ = 0.53) at both pre-stimuli, $t$(132)=-0.48, $p$=.635, 95%CI [-0.27, 0.16], $d$= 0.09 and post-stimuli, $t$(132)= -0.21, $p$=.837, 95%CI [-0.20, 0.17], $d$=0.04. The $t$-tests for explicit attitudes (NEP pre-stimuli; NEP post-stimuli) were not significant between 'aware' ($M$ = 60.20, $SD$ = 8.23; $M$ =60.50, $SD$ =9.52) and 'unaware' ($M$ =57.40, $SD$ = 8.21; $M$ =59.30, $SD$ = 9.01) at both pre-stimuli, $t$(132)= -1.82, $p$=.071, 95%CI [-5.74, 0.24], $d$= 0.34. post-stimuli, $t$ (132) = -0.72, $p$=.470, 95%CI [-4.56, 2.12], $d$=0.13. These results suggest no genuine difference in implicit nor explicit Biospheric attitudes between those who indicated they knew the study aims and those who do not,

## Appendix E

### Debrief Script

Please read the following:

As we mentioned before you commenced, this study was measuring reaction time following exposure to different stimuli. An additional aim of this study was to see whether listening to different types of stimuli would alter attitudes towards climate change. So, when we were measuring your reaction time, we were measuring the strength of the relationship your brain had made between different climate change information and emotive words like ‘good’ and ‘terrible’ – the faster the reaction time, the stronger the relationship.

The reason we used ‘limited disclosure’ when we initially asked for your consent to participate in this study was because research has shown that knowing the full aim of the study can impact the way people respond to questions, and we were trying to measure your initial response – which we call implicit attitudes. Implicit attitudes are attitudes you aren’t necessarily aware you even hold but can influence your decision making. These are the attitudes we were most interested in measuring, and one way to measure these attitudes is through measuring reaction time to different stimuli.

Are you happy for us to use your data in this study as per your original consent?
/ options = ("Yes”, No")

In case you are interested the stimuli that you were exposed was a combination of:
Leonard, C. 2016. Ablation Zone. *Antarctica: Music from the Ice*. www.allwaysnorth.com/antarctica.html (accessed 21 June 2019).

Turney, C. 2017 How Antarctic ice melt can be a tipping point for the whole planet's climate. *The Conversation*. (accessed 7 July 2019) https://theconversation.com/

Mozart, W. 1775 Piano Sonata K.283 in G Major - II Andante https://www.youtube.com/watch?v=xESOfN8tof0 (accessed 21 June 2019)

Thanks again for taking part in this study! We really appreciate your responses and time. To protect the integrity of this research we ask if you could please not disclose the topic if you talk about the topic of this study with others.

**Appendix F**

**Advertisement**

**Does the medium matter? Reaction time following exposure to different stimuli.**

Are you over the age of 18 and interested in participating in research investigating how we respond to Art and Science information?

We want to examine whether exposure to different mediums such as Art or Science can impact scores on a reaction time task. This could help in understanding which mediums are processed more quickly by the brain, and how this influences decision making.

Participation involves completing some surveys and reaction time tasks. It will take approx. 60 mins to complete.

1-hour course credit granted for first year UTAS Psych students OR optional entry into draw for one of 4 x $25 vouchers.

Please follow this link: https://mili2nd.co/yynb Or email one of the researchers below.
Thank you!

HREC: H0018021

Chief Investigator: Kimberley Norris (Kimberley.Norris@utas.edu.au)
Co-Investigator: Johanna Van Der Hek (Johanna.vanderhek@utas.edu.au)
Student Researcher: Clare Pitt (Clare.Pitt@utas.edu.au)

**Appendix G**

**Information Sheet**

**Does the medium matter? Reaction time following exposure to different stimuli.**

Welcome and thank you for being here!

This study is being conducted by Dr Kimberley Norris, Johanna Van Der Hek and student researcher Clare Pitt at the University of Tasmania.

Clare will conduct this research as part of her Honours degree in Psychology.

**This study has three phases:**

1) Firstly, a set of questions and a word sorting task.

2) Secondly, a soundtrack will play whilst more individualised questions load.

3) Finally, another word sorting test and round of questions.

Don't worry if some of the questions seem to repeat themselves. That's okay!

Please just keep answering as quickly as possible.

**Please read the following:**

1. **What is the purpose of the study?**

   The purpose of this study is to determine whether exposure to different stimuli can impact scores on a reaction time task.

2. **Why have I been invited to participate?**

   You have been asked to participate because you are over the age of 18.

3. **What will I be asked to do?**

   You will be asked to complete a number of surveys and reaction time tasks. Your participation is voluntary, and you may discontinue your participation at any time.

4. **There are no foreseeable risks to participating in this study.**

5. **Are there any possible benefits from participation in this study?**

You will be contributing to an important area of research which could help understand which forms of stimuli are processed more quickly by the brain and how they influence decision-making.

If you are a UTAS first-year Psychology student and complete the study you will receive 1-hour course credit.

If you are a Prolific participant, you will receive 5 pounds for your participation in this study.

Alternatively, you can enter a draw to win one of 4 x $25 gift vouchers.

6. **How will my confidentiality be protected?**

Data will be kept confidential and will only be accessible to the researchers. Raw data will be destroyed after five years, unless you give permission for it to be archived.

7. **What if I change my mind during or after the study?**

Participation in this study is entirely voluntary and you may withdraw at any point.

Upon immediate completion of your participation in the study, you may also choose to withdraw your data if you wish. If you change your mind more than one week after

completing the study, we will be unable to remove your data as we will have already

analysed this and included it in the final dataset, at which point we will be unable

to identify which data belongs to you."

8. **What will happen to the information when this study is over?**

The data from this study will be stored for five years on a secure computer and the

University of Tasmania's secure cloud storage facilities. Data will be destroyed after

5 years unless you give permission for it to be archived.

9. **How will the results of the study be published?**

Preliminary results will be available in 2021. If you would like a copy of these results

you can access these on the University of Tasmania Psychology website located at:

http://www.utas.edu.au/health/study/psychology. It is also anticipated that the researchers will publish this study in an academic journal.

If you would like to personally receive a summary of the results, please contact

the researchers via the email address provided below.

Please note that all data will be deidentified, therefore it is not possible to provide you with your personal results.

10. **What if I have questions about this study?**

If you have questions about the study, please contact either:

Chief Investigator: Kimberley Norris (Kimbeley.norris@utas.edu.au) or +61 3 6226 7199

Co-researcher: Johanna Van Der Hek (Johanna.vanderhek@utas.edu.au)

Student researcher: Clare Pitt (Clare.Pitt@utas.edu.au)

11. This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have any concerns or complaints

regarding the conduct of this study, please contact the executive officer of the HREC (Tasmania) Network on +61 3 6266 6254 or email ss.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number 'H0018021'.

**If you agree with the following, please continue to the study:**

1. I agree to take part in the research study named above.
2. I have read and understood the Information Sheet for this study.
3. I have read about the nature and possible effects of the study.
4. I understand that the study involves completing questionnaires measuring my knowledge and feelings, and a reaction time task.
5. I understand that participation in this study does not hold any foreseeable risks.
6. I understand that all research data will be securely stored on the University of Tasmania premises for five years from the publication of the study results, and will then be destroyed, unless I give permission for my data to be stored in an archive.
   I agree to have my study data archived. Yes, No
7. I have been given the contact details of the investigators if I have any questions.
8. I understand that the researcher(s) will maintain confidentiality and that any information I supply to the researcher(s) will be used only for the purposes of the research.
9. I understand that the results of the study will be published so that I cannot be identified as a participant.

10. I understand that my participation is voluntary and that I may withdraw at any time without any effect.

Heads up: It is EXTREMELY IMPORTANT that you follow all of the instructions during the experiment.

Please ensure you have headphones or are somewhere you can have the sound on.

Please allow approximately 45 minutes to fully complete this study.

We really appreciate your time! Thank you so much for participating! :)

## Appendix H

## Ethics Approval Letter

05 June 2019

Dr Kimberley Norris
C/- University of Tasmania

*Sent via email*

Dear Dr Norris

**REF NO:** H0018021
**TITLE:** Does the medium matter? Examining the role of Art and Science in shaping attitudes towards Antarctic and marine conservation

We are pleased to advise that the Tasmania Social Sciences Human Research Ethics Committee approved the above project on 30 May 2019.

Please ensure that all investigators involved with this project have cited the approved versions of the documents listed within this letter and use only these versions in conducting this research project.

This approval constitutes ethical clearance by the Tasmania Social Sciences HREC. The decision and authority to commence the associated research may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance from other organisations or review by your research governance coordinator or Head of Department. It is your responsibility to find out if the approvals of other bodies or authorities are required. It is recommended that the proposed research should not commence until you have satisfied these requirements.

In accordance with the National Statement on Ethical Conduct in Human Research, it is the responsibility of institutions and researchers to be aware of both general and specific legal requirements, wherever relevant. If researchers are uncertain they should seek legal advice to confirm that their proposed research is in compliant with the relevant laws. University of Tasmania researchers may seek legal advice from Legal Services at the University.

All committees operating under the Human Research Ethics Committee (Tasmania) Network are registered and required to comply with the *National Statement on the Ethical Conduct in Human Research* (NHMRC 2007 updated 2018).

Therefore, the Chief Investigator's responsibility is to ensure that:

(1) All investigators are aware of the terms of approval, and that the research is conducted in compliance with the HREC approved protocol or project description.

(2) Modifications to the protocol do not proceed until **approval** is obtained in writing from the HREC. This includes, but is not limited to, amendments that:
(i) are proposed or undertaken in order to eliminate immediate risks to participants;

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(ii) may increase the risks to participants;
(iii) significantly affect the conduct of the research; or
(iv) involve changes to investigator involvement with the project.

Please note that all requests for changes to approved documents must include a version number and date when submitted for review by the HREC.

(3) Reports are provided to the HREC on the progress of the research and any safety reports or monitoring requirements as indicated in NHMRC guidance. Researchers should notify the HREC immediately of any serious or unexpected adverse effects on participants.

(4) The HREC is informed as soon as possible of any new safety information, from other published or unpublished research, that may have an impact on the continued ethical acceptability of the research or that may indicate the need for modification of the project.

(5) All research participants must be provided with the current Participant Information Sheet and Consent Form, unless otherwise approved by the Committee.

(6) This study has approval for four years contingent upon annual review. A *Progress Report* is to be provided on the anniversary date of your approval. Your first report is due 30 May 2020**,** and you will be sent a courtesy reminder closer to this due date. Ethical approval for this project will lapse if a Progress Report is not submitted in the time frame provided

(7) A *Final Report* and a copy of the published material, either in full or abstract, must be provided at the end of the project.

(8) The HREC is advised of any complaints received or ethical issues that arise during the course of the project.

(9) The HREC is advised promptly of the emergence of circumstances where a court, law enforcement agency or regulator seeks to compel the release of findings or results. Researchers must develop a strategy for addressing this and seek advice from the HREC.

Should you have any queries please do not hesitate to contact me on (03) 6226 6254 or via email ss.ethics@utas.edu.au.

Yours sincerely

Jude Vienna-Hallam
Executive Officer I Social Sciences

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